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Summary Report on
NASA Seminar on Organization and Management

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National Academy of
Public Administration

August 1972

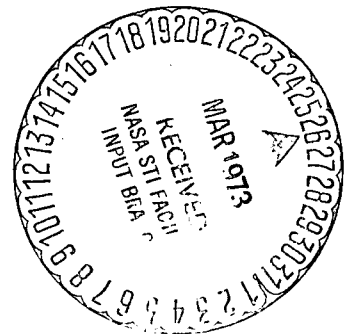


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I

Foreword

Soon after the National Academy of Public Administration was activated in the Fall of 1967, it initiated a seminar series dealing with current problems of the management and organization of NASA. The seminar was one of the initial projects undertaken in connection with a three year contract between NASA and the Academy. The 1967-68 reorganization of the space agency was a major focus of the seminar, though its total range was not limited to this event.

The seminar was designed to provide a comparative basis for understanding such recurring problems as delegation of authority, resource allocation and decision-making patterns, headquarters organization, systems of program control and evaluation, roles and relations of scientists, engineers and administrators, Headquarters-field center relationships, and the overall management philosophy of the Headquarters and the field centers.

A series of 11 monthly meetings were held. Two of the early meetings were focused on the organization and management problems of other agencies (the Office of Price Administration and the Federal Aviation Agency) to help develop deeper insight and understanding concerning such problems and to relate past experience to the NASA situation. Subsequent meetings were devoted to the 1967-68 NASA reorganization, in particular, and to matters of NASA management and organization, in general. Twenty-six persons participated in the seminar. Seventeen were senior officials from NASA, five were senior executives from other federal agencies, and four were public administration scholars. The names and titles of the participants are listed in Appendix A.

The NASA record of accomplishment is far-ranging. It encompasses both aeronautics and space and, in the latter area, both manned and unmanned exploration.

The manned exploration program has always received the greatest attention because of the spectacular nature of the technological challenges involved. With the success of Apollo 11 in July 1969, NASA won worldwide recognition for the combination of technical and managerial skills needed for the complex and difficult task of landing men on the moon and returning them safely to earth. The technical experience gained in the Apollo missions provided a record which could be captured from technical documentation and transferred to future technical undertakings. The counterpart task of analyzing and distilling the learning experience in the area of organization and management proved a much less straightforward matter and one which was open to various interpretations. Although the Apollo Management System has subsequently been codified and disseminated for application within NASA, the broader subject of the overall organization and management of the national space program has yet to be analyzed and reported systematically.

The manuscript which follows is based primarily upon the discussions in 11 meetings, supplemented by additional interviewing and data collection as required. It attempts to distill from the 850 pages of transcript the major issues and concerns discussed. It also seeks to pinpoint the most important factors which contributed to the successes of NASA and to identify some of the central problems faced by the agency in the late 1960's.

August 1972

Roy W. Crawley
Erasmus H. Kloran

Chapter 1

The Reorganizations of 1961, 1963, and 1965

NASA was created as the result of many months of study as to how the United States could best respond to the challenge of Russia's Sputnik I. The formation of the space agency was, in large measure, a response to the national concern about a possible shift in scientific, technical, and educational leadership to the U.S.S.R. At the outset, NASA faced the enormous tasks of implementing new national goals with far-reaching economic, political, psychological, and administrative effects, new and highly complex technological responsibilities, and the selection and development of personnel for tasks never before performed.

As NASA evolved and matured, experimentation and change in structure and process were essential. Its administrative history is characterized by reorganization, a period of adjustment and adaptation, and then reorganization once again.

The National Aeronautics and Space Act of 1958, which established NASA, permitted such flexibility. It specified that:

The Administration shall be headed by an Administrator, who shall be appointed from civilian life by the President by and with the advice and consent of the Senate. Under the supervision and direction of the President, the Administrator shall be responsible for the exercise of all power and the discharge of all duties of the Administration, and shall have authority and control over all personnel and activities thereof...¹

Only one other Presidential appointee -- the Deputy Administrator -- was provided for in the Act. The Act provided that the Deputy Administrator "shall perform such duties and exercise such power as the Administrator may prescribe. The

1. National Aeronautics and Space Act, HR 12575, S 3609, 85th Congress, 2nd Session, 1958.

Deputy Administrator shall act for, and exercise the power of, the Administrator during his absence or disability." The Administrator, therefore, has the authority and the responsibility to define the organization and the management principles, policies, and practices to be followed in the space program.

The first NASA Administrator, T. Keith Glennan, had the task of assembling and reordering the many diverse elements that were pulled together under the provisions of the 1958 Act. NASA's first official structure and relationships were established in January, 1959, and most of that year was devoted to launching the agency. A major organizational change took place at the end of 1959 with the transfer of the Saturn program, and the associated Army installation at Huntsville, Alabama, to NASA. The year of 1960 was a period of integration of the Huntsville activity, transfer of other facilities from the military services to NASA, and concentration on strengthening the internal management of the agency.

After two and a half years Glennan was succeeded by James E. Webb who served as NASA Administrator for eight years. Under his administration the agency geared up for the Apollo program and conducted the missions leading up to the first manned landing. As ensuing discussion will reveal, Webb's management philosophy was to exercise a substantial influence on the organization and administration of the agency.

Webb deliberately employed fairly frequent organizational restructuring in an effort to maintain management initiative and organization vitality. In this connection, Webb noted:

Thus, one of the fundamental principles of the management of NASA has been flexibility, both from the standpoint of the duties of individuals and of organizational structure. NASA had the task of achieving difficult, yet clear and unambiguous goals within an environment of very rapidly advancing technology. We did not hesitate to make the necessary organizational changes whenever they were needed to facilitate our work. As might be expected, this rather frequent use of organizational restructuring as an element of our leadership placed severe demands on us

and upon our executives. They had to retain flexibility within their current assignments and be willing to shift to new positions. We, in turn, had to personally evaluate a large amount of "feedback"²

Leadership. The choice of James E. Webb to serve as Administrator of NASA in 1961 reflected his strong political support by key members of Congress and Vice President Johnson. Webb's background also corresponded with President Kennedy's preference for a tried and proved administrator, who understood the political system and process, rather than a technical man for this post. Webb's previous experience as Director of the Budget, Under Secretary of State, and in a large number of other activities in both the public and private sector had exposed him to the intricacies of the political processes in Washington and he had developed a high capability for operating within those processes. Webb brought to his new assignment a keen awareness of the importance of an agency head's relationships with the President and the Congress. With respect to the White House, he was convinced of the importance of direct access to the President without allowing communications to be controlled by intermediaries on the White House staff. Webb's previous close relationship with the White House and the commitment of Presidents Kennedy and Johnson to the goals of the space program helped to assure the highest level political support during the pre-Apollo years. Webb also had gained extensive experience in dealing with Congress. He had observed the tendency among Congressional committees to put constraints upon agencies which appeared to be building centers of power. He recognized the importance of maintaining effective liaison with Congress, and

2. NASA, Preliminary History of the National Aeronautics and Space Administration, Foreword -- pp. vii-viii, January 15, 1969.

his prior experience had equipped him with the personal contacts and political awareness essential to such liaison.

In addition to his extensive experience in dealing with the top levels of both the executive and legislative branches of the federal government, Webb had built a record as an administrator with an understanding of organization and management. He brought to NASA some strong personal convictions about how an agency should be administered. Having served on the first Hoover Commission and later as Under Secretary of State, with the responsibility for putting into effect the Commission's recommendations concerning the Department, Webb took up his NASA duties with the conviction that it was necessary to develop "a sound basis of theory and doctrine" in administration before proceeding to action programs. At the beginning of his administration of NASA, Webb devoted a good deal of time and attention to "theoretical and doctrinal constructs and concepts." He sought to determine the level of sophistication of his principal associates in the application of such concepts in order to see how top management in NASA could best work together. In emphasizing a philosophy of management and a rationale for administration, Webb was moving counter to those elements in the agency which favored concentration of effort on "Making the birds fly" without concern for the administrative framework within which they operated. He felt that it was necessary to establish a sound organizational base which would permit effective decision-making over a long-range period and on a comprehensive basis.

Webb reorganized NASA on four occasions -- in 1961, 1963, 1965, and 1967/68. All four reorganizations primarily affected NASA Headquarters. The 1961 and 1963 reorganizations were concerned with the reporting chain of the field centers to the Headquarters. The 1965 reorganization resulted from

Dryden's death which ended the troika that had performed so effectively. The 1967/68 reorganization, and related events, were part of a continuing effort to find effective new patterns of management leadership for the space program.

The 1961 Reorganization. The first reorganization was designed to accomodate the 1961 policy decisions which resulted in accelerating greatly the NASA program -- the national goal of a manned lunar landing by the end of the decade and the development of nuclear powered rocket capability, communications satellites, and meteorological satellites. The accelerated program led to an analysis of the adequacy of the NASA organization to cope with the program. The result of the analysis was a major reorganization, in November 1961, that was designed to clarify and strengthen the role of top management and to prevent the development of autonomous bureaus. A general manager for the agency was created, a "functional management"³ concept of line-staff relationships was initiated, the Headquarters program offices were realigned in terms of program objectives, and the field centers, which formerly had reported to the various Headquarters program offices, were made directly responsible to the general manager, the Associate Administrator.

The following year -- 1962 -- represented a period of rapid growth in funding levels, personnel, and procurements as well as adjustments to the November 1961 reorganization. During the year, it became apparent that the 1961 reorganization was not working as effectively as had been hoped because of difficulties faced by field center directors in balancing the program demands placed upon them by the Headquarters program offices, which were responsible for program goals and performance, with the resources provided by top management. A chart of the revised organization appears at Exhibit One.

3. The concept of functional management is described in the following section on the 1963 reorganization. More detailed discussions of NASA management concepts appear in Chapters 3 and 4.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ADMINISTRATOR
JAMES E. WEBB
DEPUTY ADMINISTRATOR
HUGH L. DRYDEN
ASSISTANT TO THE ADMINISTRATOR
FRANKLIN N. PHILLIPS

OFFICE OF EXECUTIVE ADJT
EXECUTIVE ADJT
R. P. YOUNG

OFFICE OF GENERAL COUNSEL
GENERAL COUNSEL
JOHN A. JOHNSON
DEPUTY
WALTER SCHIER

OFFICE OF INTERNATIONAL AFFAIRS
DIRECTOR
ARNOLD W. PRUTEM
DEPUTY
MARVIN W. ROBINSON

RESEARCH COMMITTEES

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DIRECTOR
PAUL C. DEMBLING

OFFICE OF PLANNING & EVALUATION
DIRECTOR
ABRAHAM MYATT

ASSISTANT ADMINISTRATOR FOR PUBLIC AFFAIRS
HUGH T. COX

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DEPUTY DIRECTOR
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OFFICE OF PUBLIC INFORMATION
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ASSOCIATE ADMINISTRATOR
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DEPUTY ASSOCIATE ADMINISTRATOR
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DIRECTOR
D. D. WYATT

DIRECTOR OF TECHNICAL PROGRAMS
WILLIAM A. FLEMING

DIRECTOR OF RESOURCE PROGRAMMING
D. D. WYATT (ACT)

DIRECTOR OF FACILITIES COORDINATION
RALPH E. ULLMER

DIRECTOR OF MANAGEMENT
THOMAS J. JENNIS

DIRECTOR OF RESEARCH QUALITY & ASSURANCE
GEORGE E. GEPHART

OFFICE OF TRACKING & DATA ACQUISITION
EDMOND C. BUCKLEY
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EINHORN

FINANCIAL DIVISION
DIRECTOR
ROBERT B. LEWIS

ADMINISTRATIVE SERVICES DIVISION
DIRECTOR
STEPHEN J. CRILLO

PROCUREMENT & SUPPLY DIVISION
DIRECTOR
ERNEST W. BRACKETT

PERSONNEL DIVISION
DIRECTOR
ROBERT L. BELL

SECURITY & INVESTIGATIONS DIVISION
DIRECTOR
JOHN D. YOUNG (ACT)

OFFICE OF AERONAUTICS
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MORRIS TEPPER

DIRECTOR OF SPACE & NUCLEAR SYSTEMS
NAROLD B. FINGER

DIRECTOR OF AERONAUTICAL RESEARCH
JOHN P. STACK

DIRECTOR OF PROGRAM REVIEW & RESEARCH
BOYD MYERS II

DIRECTOR OF SPACE VEHICLES
MILTON B. AMES

DIRECTOR OF ELECTRONICS & POWER GENERATION
ALBERT J. KELLEY

OFFICE OF SPACE SCIENCES
HOMER E. NEWELL
DEPUTY DIRECTOR
EDGAR M. CORTRIGHT

OFFICE OF MANNED SPACE FLIGHT
DIRECTOR
D. BRAINERD HOLMES

DIRECTOR OF PROGRAM REVIEW & RESEARCH
JOHN D. NICOLAIDES

DIRECTOR OF SYSTEMS ENGINEERING
MICHAEL C. GOLOVIN

DIRECTOR OF PRODUCTION & RESOURCES
WILLIAM E. LILLY

DIRECTOR OF COMMUNICATIONS SYSTEMS
LEONARD JAFFE

DIRECTOR OF SPACE VEHICLES & PROPULSION
DONALD HEATON

DIRECTOR OF LAUNCH VEHICLES & PROPULSION
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HOMER E. NEWELL
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DIRECTOR OF SYSTEMS ENGINEERING
MICHAEL C. GOLOVIN

DIRECTOR OF PRODUCTION & RESOURCES
WILLIAM E. LILLY

DIRECTOR OF SPACE CRAFT LAUNCH VEHICLES & PROPULSION
MILTON W. ROSEN

DIRECTOR OF SPACE CRAFT LAUNCH VEHICLES & PROPULSION
MILTON W. ROSEN

DIRECTOR OF SPACE CRAFT LAUNCH VEHICLES & PROPULSION
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MILTON W. ROSEN

DIRECTOR OF SPACE CRAFT LAUNCH VEHICLES & PROPULSION
MILTON W. ROSEN

APPROVED: *James E. Webb*
JAMES E. WEBB
ADMINISTRATOR, NASA
DATE: November 1, 1961

DATE: SUPERSEDES CHART DATED AS JUNE 1, 1961

MARSHALL SPACE FLIGHT CENTER
DIRECTOR
WERNER VON BRAUN

AMES RESEARCH CENTER
DIRECTOR
SMITH J. D'FRANCE

LEWIS RESEARCH CENTER
DIRECTOR
ARE SILVERSTEIN

FLIGHT RESEARCH CENTER
DIRECTOR
PAUL F. RINKLE

GODDARD SPACE FLIGHT CENTER
DIRECTOR
HARRY J. GOETT

JET PROPULSION LABORATORY
W.H. PICKERING
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Wallops Station
DIRECTOR
R. L. KRIEGER

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DIRECTOR
FLOYD L. THOMPSON

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DIRECTOR
ROBERT R. GILRUTH

WESTERN OPERATIONS OFFICE
DIRECTOR
ROBERT W. KAHN

The 1963 Reorganization. The year of 1963 was a time of great debate over NASA's mission, a changing pattern of external support, a leveling off of the agency's budget, and a growing awareness of the inadequacies of the 1961 reorganization. One result of these forces was a reorganization, in November 1963, which reversed the provision of the 1961 reorganization that placed the field centers under the general manager. In effect, this reorganization recombined program and institutional management by placing the centers under the Headquarters program offices, thereby facilitating decision-making at lower organizational levels and emphasizing simplified command lines. A chart of this reorganization appears at Exhibit Two.

In addition, the 1963 reorganization placed increased emphasis upon the "functional management" concept which was designed to balance and round out the authorities incorporated in the line structure by the assignment of broadened responsibilities to the Headquarters offices.

Functional managers in such areas as procurement, personnel, resource control, and other administrative specialties were called upon to play a stronger role than that of merely furnishing staff advice to line officials. Functional managers were charged with the broad responsibilities of observing and evaluating the manner in which their functions were being performed throughout NASA and insuring that functional needs were met in a way that accomplished institutional as well as program objectives and was consistent with policy and sound practice. In effect, decisions were perceived as inadequate if they failed to take into account the functional and administrative requirements of the agency as defined by law, regulation, management policy, or the dictates of sound management practices. Functional managers were expected to define these requirements, and line managers were expected to give the requirements full consideration in shaping their own decisions at every level in the

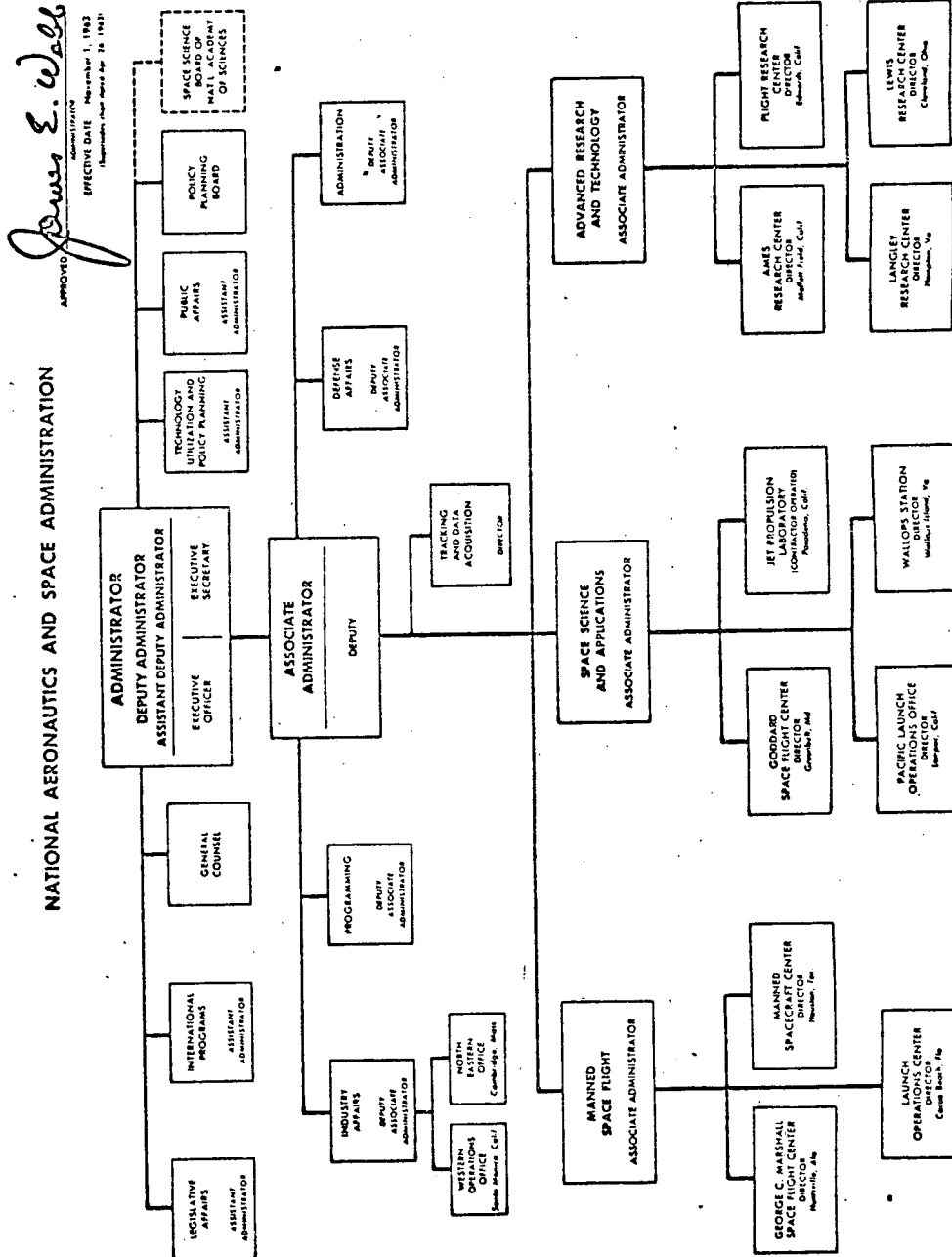


Exhibit II

organization. Under this concept, functional managers had two bosses, since they had to be supportive of line officials while assuring top management that every decision was based on a balanced judgment which reflected administrative needs and constraints as well as program requirements.

Webb expressed the concept as follows:

Functional management, as we perceive it, is a means of optimizing administrative specialization, while, at the same time, retaining the essential ingredients of traditional line management concepts. It is an effort to cope with the persistent problems we have in modern complex organizations of solving the dilemma between hierarchy and specialization.⁴

Although these changes directly affected the individual relationships between the top staff of the centers and their Headquarters counterparts, the effect upon the vast majority of center personnel and the manner in which they carried out their day-to-day operations was a good deal less substantial. The field centers have continued throughout the lifetime of NASA to maintain their separate existences, their own styles of management, and, to a greater or lesser degree, their own momentum. As one of the seminar participants observed: "The amount of control you exert centrally can squelch the decentralized groups completely and kill off initiative and authority."

The period from 1964 through November 1965 was a time of relative organizational stability. The pattern of Headquarters-field center relationships continued unchanged. The top-level collegial approach -- Administrator Webb, Deputy Administrator Dryden, and Associate Administrator Seamans -- to the overall management of the agency proved to be highly effective. It appeared that the agency had shaken down in terms of organization and programs and that the management and execution of its accelerated programs would constitute the major tasks.

4. James E. Webb, Administration and the Conquest of Space, Conference of the American Society for Public Administration, Detroit, Michigan, April 1e, 1962.

End of the Troika and the 1965 Reorganization. In late 1965, Dryden died, thus ending the highly successful troika and setting in motion a search for effective, new leadership patterns that was to continue for several years. The initial step in this process was to appoint Seamans as Deputy Administrator while continuing his responsibilities as general manager for operations. In effect, Seamans assumed Dryden's former responsibilities in addition to those that Seamans had been performing. A revised organizational structure for NASA Headquarters was established in December 1965 (See Exhibit III). This reorganization created an Office of the Administrator with the following operational pattern:

...delegations of authority and responsibility to the Deputy Administrator to enable him to serve on a day-to-day basis as general manager of the agency and to serve as Acting Administrator in the absence of the Administrator...These delegations to the Deputy Administrator will be complete, and it is expected that he will, on a day-to-day basis, take final action on most matters, except where there are legal or special requirements that necessitate personal action by the Administrator.⁵

In a memorandum of December 29, 1965, to the "Heads of All Headquarters Offices and Directors of Field Center," Webb, in amplification of the changed responsibilities, stated:

As Administrator, it will be my purpose to rely fully and completely on Dr. Seamans, as general manager, to conduct the affairs of the Agency in conformance with both agency and governmental requirements and in accord with the broader context within which we must operate. He will keep me fully informed, as I will him. On policy and actions having more than ordinary implications, we will, whenever possible, consult together before either takes action. The Associate Administrators in charge of Program Offices, both individually and collectively, will be encouraged to prepare for and undertake more of the NASA-wide responsibilities of general management under the direction of the Deputy Administrator.

5. NASA, Preliminary History of the National Aeronautics and Space Administration, Chapter VI, pp. 12, January 15, 1969.

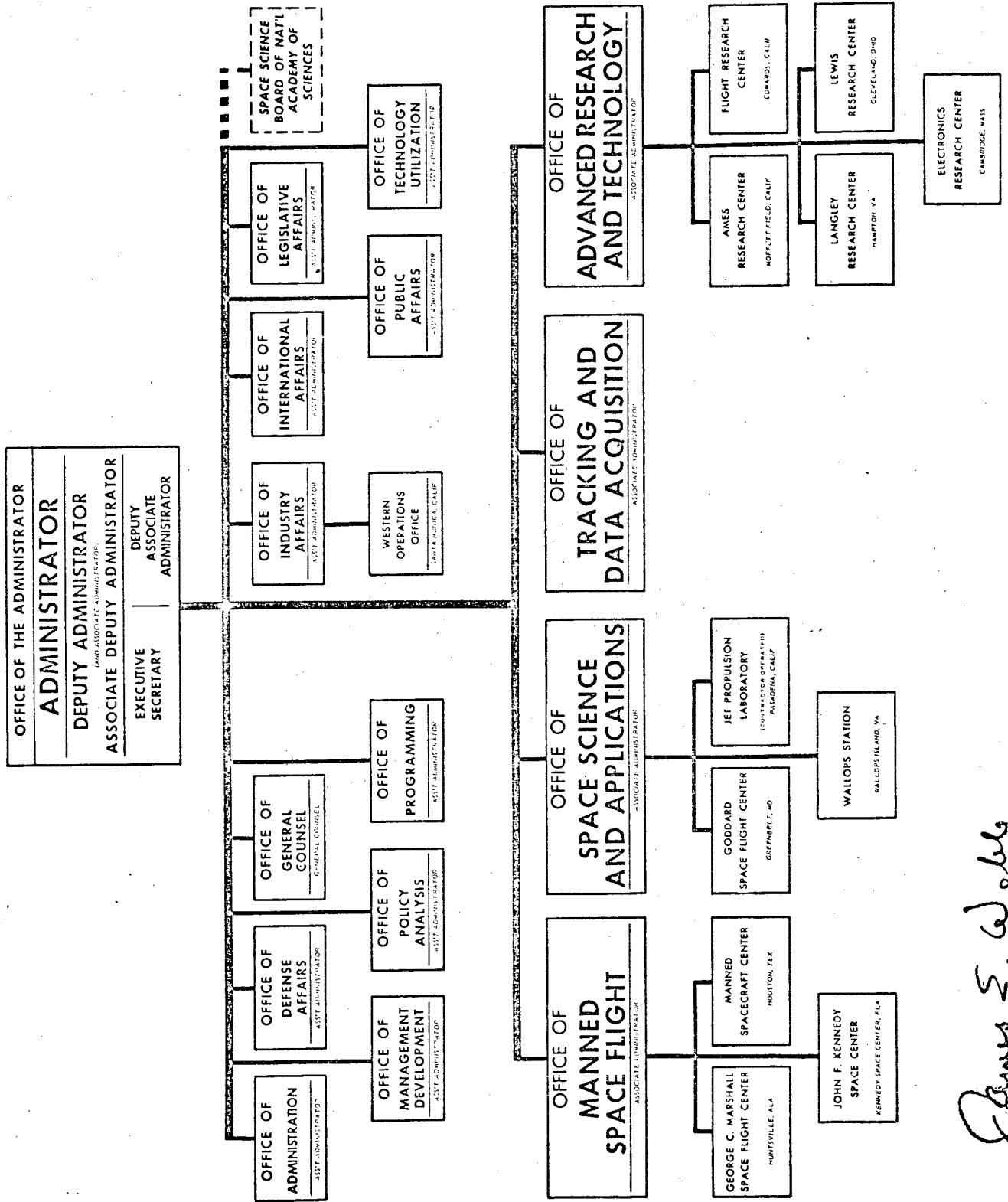


Exhibit III

ADMINISTRATOR

0071, 13, 1 MONDAY

-- There will be continued emphasis on the development of workable patterns of strong NASA-wide functional coordination and supervision of those elements of policy and administration which can be fully effective only if an acceptable degree of NASA-wide coherence and consistency is achieved. All functional staff offices will report to the Deputy Administrator. Together, they will constitute a single central functional staff serving the Office of the Administrator and also serving the Associate Administrators in charge of program offices to the fullest extent possible.

The 1965 reorganization, in addition, defined the functions of the Secretariat, headed by the Executive Secretary, as assuring effective communications throughout NASA, insuring that proper coordination has been provided and policy accurately reflected in matters coming to the Office of the Administrator, expediting and scheduling the flow of work in that office, and providing central reference and office services in the Office of the Administrator.

Dryden's death left a serious gap in NASA leadership. His absence was felt most acutely at senior levels of administration where he had served as an arbiter in the complex decision-making process on matters of scientific and technological content. No other individual could be found who combined all of the information and knowledge which had permitted Dryden to provide the kinds of judgments and counsel he had offered up until his death.

Chapter 2

The 1967 - 68 Reorganization

At about the same time that Dryden's death brought the troika to an end, the nature and scope of the concerns of NASA senior management began to undergo significant change. Increasing attention had to be focused on the broad questions pertaining to the future of the space program. Many of the new issues involved considerations external to NASA and beyond the agency's control.

Rationale. For NASA, 1967 was a year of highly significant, even traumatic events. The search for an effective alternate leadership pattern to the troika continued, the Apollo 204 fire occurred, Seamans resigned as Deputy Administrator and general manager of operations, and Newell (former Associate Administrator for Space Science and Applications) was elevated to the revised position of Associate Administrator.

On January 6, 1967, a special task force was appointed to analyze and strengthen NASA's organizational structure. Three weeks later, January 21, 1967, the Apollo 204 fire occurred at the Kennedy Space Center. The subsequent report of the Apollo 204 Review Board,⁶ and the task force study resulted in a number of measures aimed at improving both the technical and the management

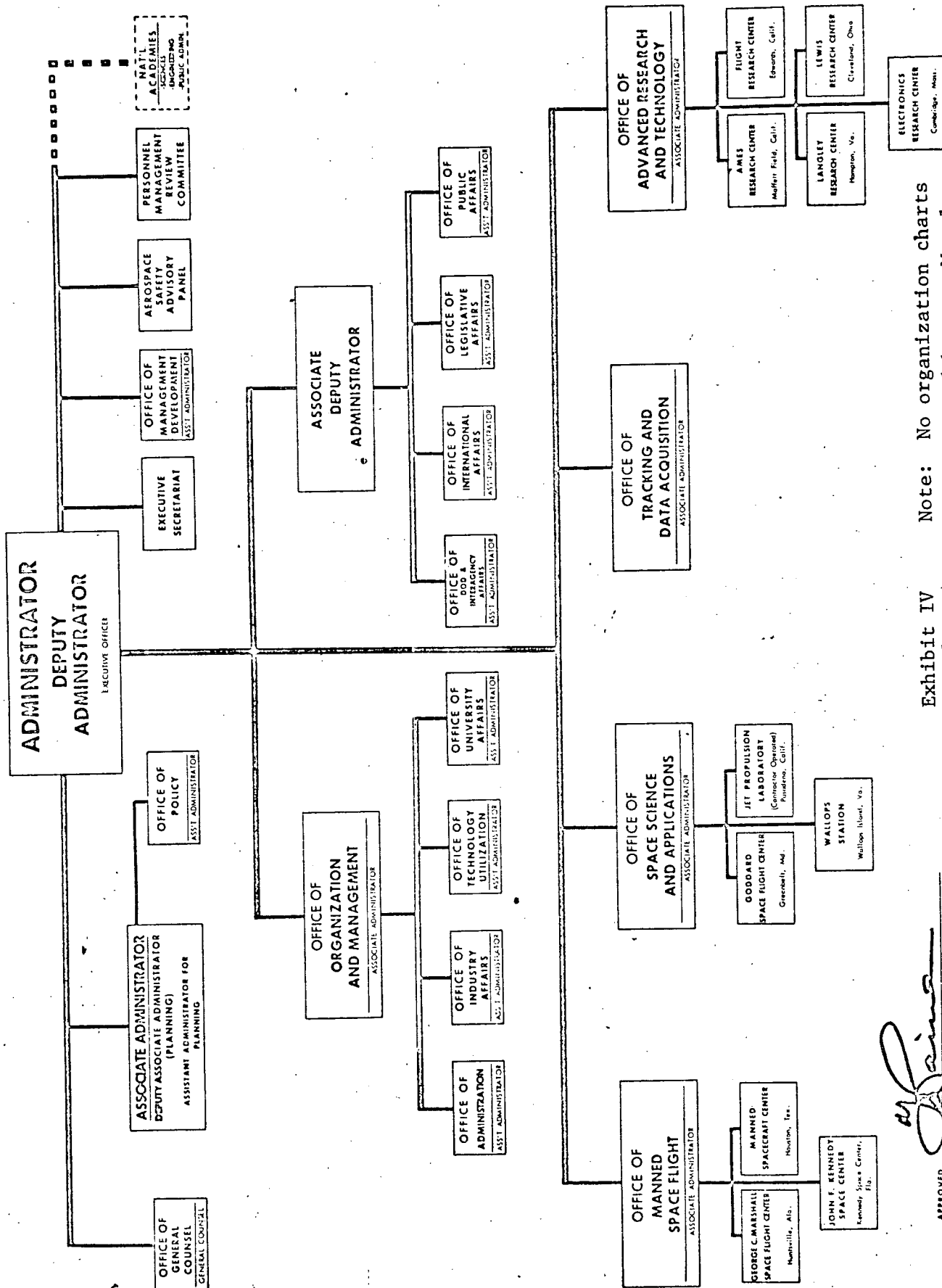
6. The complete documentation of the investigation of the Review Board has been impounded for ten years.

aspects of the space program. In essence, these measures were aimed at preventing future problems of a potentially serious nature by insuring that the "self-policing" features of NASA's organization as well as those elements of the overall management system designed to provide advanced warning of potential problems were functioning effectively and were providing the required visibility to all levels of NASA management. The 1967-68 reorganization stretched out over a period of about a year and a half. At the conclusion of this process the agency had assumed the new organizational pattern illustrated at Exhibit Four.

Office of Organization and Management. A major step, designed to upgrade the management of NASA, was the establishment, in March 1967, of an Office of Organization and Management under an Associate Administrator. This Office brought together a number of previously separate offices concerned with various facets of NASA management -- administration, industry affairs, technology utilization, and university affairs. It represented a more integrated structure of functional and administrative offices and provided a stronger focus for effective management and for assuring the balance necessary for overall decision-making.

The Associate Administrator for Organization and Management was made responsible for the development and implementation of major mechanisms for agency review and approval of management actions and resources. He was expected to ensure that: (1) decisions reached through such processes represented the best balance of judgment of line management needs and functional administrative needs; (2) agency policies and practices were followed; and, (3) the requirements of external entities -- Congress, General Accounting Office, Bureau of the Budget (now Office of Management and Budget), Civil Service Commission, etc., -- were understood and recognized. The underlying concept

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



Note: No organization charts were issued between May 1, 1968 and May 1, 1970.

Exhibit IV

[Signature]

APPROVED

1 MAY 1970

Supersedes chart dated May 1, 1968

NASA-HQ

for the Office of Organization and Management was perceived as one of management "checks and balances," but the emphasis in the activities of the Office was to be placed upon complete and well rounded decisions, both for the present and the future.

In addition, the Associate Administrator for Organization and Management was assigned major responsibilities in personnel management. Webb, in describing this role, stated that this Associate Administrator:

...works closely with the Administrator to emphasize that, in NASA as an R & D organization subject to tendencies to relegate administration to a secondary position, all senior officials must accept responsibility for developing improved means for judging the administrative performance of subordinate officials; develops criteria for selection upward of R & D personnel who also demonstrate administrative competence and the transfer to non-administrative specialities of those who cannot grow in both program and administrative areas.⁷

Realignment of Senior Administration. In September, 1967, Seamans announced his intention to resign as Deputy Administrator and general manager of operations at the end of the year. This decision meant that a new set of top management relationships had to be created which would continue the effort to improve top leadership and management and would provide for effective allocation of the workload and responsibilities of Seamans.

Several actions were taken in late 1967 in an effort to strengthen NASA management. To expedite the process of policy definition and dissemination, an Office of Management Development, headed by an Assistant Administrator, was created to take the lead in developing agency policies, procedures, responsibilities, and authorities. Vice Admiral Charles E. Weakley, USN (Ret.), was appointed to the post.

7. NASA Management Issuance 1130.1, Subject: "Roles and Responsibilities -- The Associate Administrator for Organization and Management."

In December, 1967, the Headquarters offices concerned primarily with external relationships -- international affairs, legislative affairs, public affairs, etc. -- were brought together under the direction of Willis Shapley, Associate Deputy Administrator, and the activities of the office dealing with DOT relationships were expanded to include relationships with other federal agencies.

In addition, Homer Newell, then Associate Administrator for Space Science and Applications, was elevated to the revised position of Associate Administrator. Webb assigned Newell, in this new role, the initial task of identifying the key elements in the NASA management philosophy and applying these concepts in the development of a sound system of organization and administration for the second decade of the space program. Newell, after several months of analysis, formulated a set of management "principles" and organizational proposals.⁸ In the process of conducting this analysis, Newell identified a number of problems and deficiencies in the management and organization of NASA. He then attempted to relate the management "principles" he identified to alleviating these underlying problems. The "principles", underlying problems, and organizational remedies were discussed at length in the seminar.

The "Principles". Newell's analysis of the underlying problems of NASA organization and management resulted in the formulation of the following nine management "principles."

1. Cohesion. The organization should be structured and used so as to bring its elements together rather than divide them. The Management Council, to be described later, is an example of an organizational device calculated to bring

8. Notes for National Academy of Public Administration Seminar, "Management Principles Bearing on NASA Organization and Management," October 1968.

the program offices together so as to counter divisive tendencies. The application of this principle will become more evident in connection with other principles developed below.

2. Participation. The organization should operate so that its various elements are represented in fact-finding and discussion where their interests are concerned and/or where they have a contribution to make. This does not mean that unanimity is required to reach decisions or that a majority should rule. There should be no attenuation of responsibility for decision-making or leadership at various management levels. However, management should exercise its leadership and reach its decisions through a time-limited process of fact-finding and consideration which utilizes both participative and consultative techniques.

3. Structure. The organization should be structured so as to provide a good match to the agency's goals and objectives. Inasmuch as major objectives change with time, the agency must be willing to change its organization from time to time to adapt to new circumstances and needs. On the other hand change must not be too frequent; a reorganization should be designed to be viable and effective for a sufficient period of time to foster a sense of stability, purpose, and direction.

4. Dynamism. Both the structure and the operations of the agency should consciously aim at preserving dynamism, or freshness in spirit and action. This is a matter of vitality rather than change per se. Change alone does not create vitality, though it is often confused with and may indeed retard it. A readiness to change to correct deficiencies or achieve new goals is, however, essential to dynamism. Other factors which can contribute to vitality are the choice of challenging but achievable objectives, delegation of responsibility,

proper supervision, leeway to experiment at lower levels, opportunity to create, adequate but minimal structure and process, and ready reward for performance.

5. Open Decision-Making. Decision-making at all levels should be based on consideration of all relevant factors. To the extent that it is compatible with available time and appropriate substance, there should be open discussion of these factors and of the alternatives available to management. This is not only consistent with the other principles listed here, but will serve to strengthen their application.

6. Self-Policing. To the extent that it is consistent with economy, expedition, morale, and the clear assignment of responsibility, the organization should be structured so as to provide for checks and balances. If properly done, this is in the interests of both the agency and the individual. There is, however, a delicate line between constructive and destructive checks and balances. Useful "conflict" can be achieved through structured discussion among peers, through fact-finding techniques, and through adequate supervision. These devices are greatly to be preferred to "conflict" generated by duplicating or overlapping action or line assignments. Thus, a Management Council provides constructive checks upon the planning and performance of program administrators; the grouping of external functions under a single head provides constructive checks upon each of the external function administrators; and NASA's source evaluation technique protects the agency when properly applied in difficult decision-making. Duplicate assignments to study, analyze, review, or recommend can be very useful if structured to preclude misunderstanding and surprise. On the other hand, where operational responsibility is involved, as in action or line management assignments, duplicate assignments can be devastating, tending to

confuse responsibility, introduce divisiveness, attack morale, increase confusion inside and outside the agency, and increase the work on some items while dropping others between the cracks.

7. Scope and Limits for Expertise. Adequate scope and authority should be given to both program and staff office expertise. Internally, this question has been greatly clarified by the Administrator's strong emphasis upon functional staff responsibilities. Externally, a working partnership should apply. Where both program and staff representation is required externally, each should speak to its peculiar subject matter within the ranking framework of the agency's structure. Prior coordination should be necessary before speaking for an area outside a representative's expertise. The principle of constituencies or clientele is also helpful in sorting out the proper relationship of programmatic and functional responsibilities; each should respect the communications lines required by the other in day-to-day activities. These considerations will best serve the agency's interests in dealing both internally and externally.

8. Constituency or Clientele. In establishing proper relationships among programmatic and functional responsibilities, each program and staff office should respect the communication lines required by the other in day-to-day activities. Each should keep the other informed, bring the other in on appropriate matters, and arrange for the official with the responsibility to carry out the representation function, wherever possible.

9. Economy of Effort. Most of the above principles can be served through a broad gauged effort to conserve energy for the main purpose. In other words, to minimize overlap, avoid undue conflict, ensure maximum job effectiveness and satisfaction, and increase overall organic efficiency. A conscious attempt

should be made to request only that effort which will be used and to use the effort that is requested. This implies diligent staff work and imposes on management a requirement for guidance and review comparable to the requirement upon other levels for implementation. Adherence to the next five sub-principles will contribute to achieving economy of effort.

a. Guided Staff Work. Adequate instructions to staff, and time devoted in advance to understanding the purpose and scope of an assignment, will reduce the amount of wasted effort, increase understanding between levels of management, and improve the quality, quantity, and usefulness of staff work.

b. Action-Orientation. The organization should cultivate the practice of moving out with administrative actions which are adequate in substance, even if on an interim basis only, rather than delaying action in order to polish and re-polish. Experience is a better polisher, in any case, than extended debate prior to experience. Unduly protracted consideration gluts the decision-making process and depresses the level of staff expectations and confidence.

c. Focus. The use, assignment, and development of individuals should more often be focussed than diffused. It is important to involve selected personnel in varied assignments calculated to develop their capacities and experience, but careful consideration must be given at the same time to the personal and agency stake in continuity and focus.

d. Clustering. The grouping of related functions is another important device for achieving focus, enhanced strength, and economy.

e. Quality of Staff. Management should give attention to acquiring, developing, and maintaining a high quality staff, and to properly placing and using personnel.

The Underlying Problems. In describing the above principles, Newell stated that they had been formulated, not as an abstraction of something that is good inherently and so should be followed, but rather in response to a problem that NASA had confronted in the past or faced at present. In formulating the principles, therefore, an approach to resolving the problem or the problems is implied. To illustrate this relationship between principle and problem, Newell remarked that the first principle -- Cohesion -- was derived from the pattern developed during the early years of NASA which tended, both organizationally and in operating practice, to divide the agency. The agency had a tight, neat division into science and application, into technology, into manned space flight, etc. That organization tended to separate programs and staff and to make coordination and integration difficult. Moreover, the processes for program review and decision-making tended to enforce that decision. Status reviews were conducted for each program individually with no involvement of officials from other programs. It was almost as though top management was sending signals down through the organization saying, "Don't bother with each other." This impression was enhanced by the fact that not only was the review process carried on in that manner but even the decision process was. Program directors reviewed programs and projects with the general manager who would then make decisions. Program directors were given little opportunity to debate, in open forum, the pros and cons of what each of them was proposing versus what the others were proposing or the allocation of resources to various programs.

The Open Decision-Making principle stemmed from the fact that, in the past, program officials felt that some of the hidden staff operations -- and there were many of them -- had the power of pocket veto. In other words, there were functional staff groups so placed in NASA that, although they were

not in the decision-making stream, program matters had to go through them. As a result, just by taking undue time in the review process or by saying certain things in secret to the general manager, they could stop progress and it became an interminable effort to find out what was going on. There was a tendency for a variety of decisions to be made in little conclaves without consideration of all the factors in an open forum where the give and take of their relative values were considered. Decisions were made in areas for which program directors had responsibility but without their participation in the decision-making process. A participant observed that this situation was not perceived by top management as harmful to program directors. He felt that, if it had been so perceived by top management, the process would have been changed. A second participant remarked that there are prerogatives of the commander or of the executive to make a decision at some point whether or not it pleases everyone. After a reasonable amount of consultation, the organization has to accept a decision which may not always be equally comfortable to everybody. Another participant responded by noting that the central point is that, if the consultation is genuine and timely, then it is not damaging. If it is perfunctory or pro forma or not real, then it is damaging. And program officials in NASA regarded the process as of the latter type.

The Dynamism principle derived from what seemed to be a change in flavor, a change in spirit in the organization due, perhaps, to a combination of factors -- the effects of the war in Viet Nam, declining support and resources, and the fact that many of the programs agreed upon in the first round of setting objectives were still in process. Seamans, before he left NASA, became disturbed because he found that some of the centers were telling him they could not perform this task or carry out that program. He commented: "This is backwards.

The normal pattern is for the center to drag Headquarters along and for Headquarters to hold the centers somewhat in check. That is the way it should be with the centers way out ahead and pulling Headquarters along. Something is wrong when the centers indicate they cannot undertake a new program, they have enough to do, and want to be left alone." A participant commented that the centers had been operating in a climate in which the Voyager program was eliminated and in which it was not permissible even to think about a manned planetary program. With such a climate, it seemed a waste of effort to be imaginative. All the pressures were at work to cause the centers to become conservative. Another participant remarked that NASA formerly had a balanced program that greatly extended staff capability over a period of five years or so into the future. At present, the program consists of undertaking projects that are easily within staff capability and one which has dropped out all future activities. A third participant observed that there is some force that becomes operative after seven or eight years of organizational life which generates within the organization an approach of conservatism and makes it easy to rationalize resource restraints and other limitations. As a record of accomplishment is built, the tendency is to look back at that record and not at where you ought to be going. In addition, you learn what you cannot do readily and so tend toward conservatism. Also, a legislative history accumulates and constitutes a restraint. Other operative factors include an over preoccupation with documentation, of being able to prove that the right decisions were made all through the process, and of being able to justify actions to GAO. The average age of staff increases and the process of renewal and rejuvenation becomes much more difficult. Another participant commented that the problem is that people become institutionalized around specific

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programs and it becomes extremely difficult to change the institution, because vested interests have developed.

The Self-Policing principle stemmed from the fact that there was a tendency to apply the inspection-type, Gestapo approach to activities that many people felt could be better treated by effective use of organizational autonomy and proper processes. In the check-and-balance system developed within NASA, there was a process of pulling up inputs from program offices, turning them over to another group, and having that group review the programs to make certain the program directors were not withholding information or slanting data, and then feeding the results of the review to the general manager. The analysis did not go back via the program office and there often was a surprise confrontation when the final decision was announced. There was, in essence, considerable confusion over information-gathering for intelligence purposes and the manner in which the information was used. The problem was that, when information had to be gathered, there was a group off to the side that was given the task of collecting the data and feeding it into the top decision-maker. The line organization was left in the dark as to what was going on. And this damaged the agency since it was the line organization that had the knowledge, expertise, and ability to gather the appropriate data and to make it available. The process followed meant that the senior decision-maker abdicated his responsibilities by becoming a prisoner of his staff and the staff made decisions that should have been made by the line operators and without an input from the line. A participant remarked that this conflict between representativeness and checks and balances is one of the great paradoxes of all advanced western societies. If representativeness is emphasized, everyone gets into the act. If you stress checks and balances, the results seem totalitarian. This is a

key problem in public agencies at all levels. It is a cultural problem that permeates the society. No one knows how to do it. Another participant remarked that there is no formula for resolving the conflict. But he noted that, when it is solved on a day-to-day basis, a high degree of efficiency is achieved.

The Organizational Remedies. To help resolve the problems described in the previous section, Newell recommended, and obtained approval for, the establishment of a Management Council and a Planning System.

The Management Council, as conceived by Newell, was to be an integral element of NASA's overall management and organizational structure. Its membership was to include the Associate Administrator (chairman), the General Counsel, the Associate Deputy Administrator, and the Associate Administrators for Advanced Research and Technology, Manned Space Flight, Organization and Management, Space Science and Applications, and Tracking and Data Acquisition. The Administrator and Deputy Administrator were to serve as ad hoc members.

All NASA officials reporting directly to the Administrator were expected to be full participants in the total management process rather than being concerned primarily only in managing and promoting programs and activities for which they had line responsibility. Thus, there was to be an organic element designed to draw elements of the agency together and to provide a forum where major decisions of the agency were based on the best thinking and reasoned judgment of the agency as represented by the Council.

The Council was to hold half-day meetings routinely once a week, expanding these meetings each month into an all-day session designated as a General Management Review. Additional meetings were to be held at the call of the chairman as necessary. Structured agenda were to be distributed in advance

to permit preparation for participation. The chairman was to arrange for cognizant NASA officials to take whatever implementing or other actions were required as a result of Council deliberations. The chairman was to be authorized to establish ad hoc panels or committees as necessary to conduct the work of the Council. The activities of the routine half-day and special meetings were generally to consider implications, provide guidance, and set policy relative to matters appropriate to bring to the Administrator's level. The all-day monthly meetings, or General Management Reviews, were to be conducted as information exchanges rather than as decision forums and were intended to provide management with an agency-wide awareness of pending problems, needs for policy statements, and implications relating to NASA's interaction with other agencies. Decision meetings, implied as a result of these monthly meetings, were to be conducted in the established line elements of the organization.

The Planning System was to involve steering, coordinating, and working groups, led by senior line managers and scientists with representation from Headquarters program and functional offices and from the field centers, to develop planning options on a disciplined basis. These options were then to be formulated into overall agency program alternatives for consideration by top management.

The Planning System was perceived as the agency-wide procedure for:

- (a) developing plans, programs and budgets for consideration by NASA management for internal planning purposes; and
- (b) developing data and information required for NASA's annual submissions to the Bureau of the Budget (now Office of Management and Budget) including program memoranda and budget material. The objectives of the System were to:

1. identify major programming and budgeting issues for management consideration and decision.
2. provide a basis for budget submissions to BOB.
3. develop significant alternative program possibilities so that management decisions and recommendations can be knowledgeably and effectively determined.
4. involve a wide representation of headquarters, centers, line, and staff elements in the annual budgetary process.
5. relate the Planning System in a fundamental way to subsequent program development and project approval processes.

A Planning Steering Group was to be established to receive and elaborate guidance from the Administrator and his senior associates, including the Management Council, to guide and review the activities of the Planning Coordinating Group, described below, and to make appropriate submissions to the Management Council and the Administrator.

A Planning Coordinating Group was to be established to receive guidance from the Planning Steering Group, to coordinate the preparation of annual planning through Working Groups described below, and to submit the results of such planning to the Planning Steering Group for review and direction and eventual submission to the Management Council and the Administrator.

Working Groups were to be established for the preparation of planning in each of a number of program categories describing major coherent portions of the NASA program and in such additional categories as may be considered desirable. The tasks of the Working Groups were to define goals and objectives in each program category, to identify major programming and budgeting issues, to develop meaningful alternative program and project

approaches to meet the objectives of each program category, to provide bases for evaluation of such alternatives, to provide for or identify special analyses required, to point out the immediate and long-range implications of such alternatives, and to provide such additional or modified material as may be desired by management and/or the BOB.

Each Working Group was to develop Planning Source Documentation which collected and organized the basic data prepared in carrying out the above tasks and which was to be used as a source for the Program Memorandum to be prepared by the chairman of the Working Group. Additionally, the Planning Source Documentation was to be a source of material required for future Project Approval Documents and material of relevance to long-range planning.

Reactions of Participants. Although the reactions of the participants to the "principles," underlying problems, and proposed organizational remedies varied considerably, there were certain areas of agreement. First, the reactions were revealing in disclosing how little consensus there was on "principles" or on the theory or doctrine to which they related. While there was no discounting of the basic importance of organization and administration as central factors in determining performance, there was no concurrence that NASA's success could be correlated with particular organization and management systems per se. Nor was there agreement that NASA's emerging problems stemmed primarily from organization and management considerations.

The participants emphasized that, after a serious effort to identify some new and innovative concepts which would fall together into a total conceptual framework, the analysis produced only an elaboration of some

well-known precepts. For each "principle" adduced to explain a management approach or technique used successfully, there appeared to be a contrary "principal" which was applicable in other times or situations.

One participant commented that the principles struck him as a guide to good behavior by top management prepared by middle management. Many of the principles constitute things top management should not have done or should have done in a different way. The principles represent the kind of document that the Barons of Runnymede would have signed in order to get proper behavior from King John. But they are not what Machiavelli would have advised his Prince in connection with running his domain, either from the viewpoint of administration or the totality of the job. In his opinion, the principles seem incomplete and underestimate the long-term values of a good deal of healthy disagreement and leadership behavior that end up being very productive in the long run, even though they are difficult for the staff to live with in the meantime.

Another participant noted that, when a program is expanding with considerable resources and many projects, the management situation is quite different than when the program is being consolidated with an emphasis on internal control. In other words, the principles change to reflect program development, thrust, and emphasis.

It was pointed out that the "principles" had not determined the existing organizational structure or the operating procedures of NASA. A participant observed that it must be kept in mind that there was a real distinction between the way NASA actually operated and the "principles."

There was general agreement among the participants that the external environment within which NASA operated had changed greatly and this change,

in part at least, was reflected in Newell's analysis. One participant observed that, during the period in which Newell made his analysis, there was a full change in the external environment. It changed drastically from the standpoint of White House and Congressional support which declined as the program evolved and as other national issues and problems arose. A large part of the increased control, implicit in the Newell approach, was a reaction to the fact that it was necessary to exercise increased control because top management had new and major problems due to changes in the external environment.

It was pointed out that there had been three criteria for investment in the space program: (1) national survival based upon fear of the achievements of the Russian space program; (2) economic growth and the provision of jobs; and (3) cultural development including man's desire to know himself and his environment. The first two criteria do not drive the space program today and, with the Viet Nam war and the myriad of domestic needs, the cultural criterion is not persuasive when the space program has been built to almost a \$6.0 billion level with a \$2.5 billion overhead. Then the world around NASA changed in terms of criteria for investment. This caused NASA leadership to become introspective and to focus on the relatively unimportant -- for the time -- problems of management and difficulties that arose within the management group. But if NASA leadership is to be useful in helping to determine how the enterprise is to be used in the future, it must begin to look in the marketplace and determine what the market is for various NASA capabilities.

Another participant expressed the feeling that Newell developed the principles as devices that are necessary to enable NASA to deal better with

new problems which arose mainly from the external environment. The changes required related more to the political situation than to the technical aspects of making intelligent decisions as to how agency planning should be carried out and when the planning should be exposed to public scrutiny.

Third, the participants felt that Newell had identified a number of management and organizational problems and deficiencies that had existed for some time. One participant commented, "The last piece of paper we sent through involved relatively minor policy. It concerned the NASA position relative to reimbursement for supersonic testing. The clearance process should have taken a few days. It took months.

As one member observed, "How we learn to deal with the effects of increased program magnitude in an element of a cluster -- whether that element ought to be split off and what such action would mean to the Headquarters organization from an effective management point-of-view and with regard to the reporting chain from the field centers to the Headquarters -- is a major problem now confronting NASA."

Another participant remarked that the situation of the field centers was very difficult. Their programs have fallen off but they do not have flexibility in paring down the work force. The centers do not know how to cope with Civil Service procedures in such a way that, in reducing the size of the staff, the best people can be retained and the less competent terminated. The presumption is that the system works exactly the opposite.

Finally, there was a feeling that Newell's proposed organizational remedies had merit. One participant stated that Newell's work had already had a noticeable influence in increasing participation in the overall decision-making process. Most Headquarters staff and program offices are now aware

of, and interested in, the problems of the other offices. This was not the case before Newell's analysis. Moreover, the field centers -- which formerly were rather parochial in their viewpoints -- are now becoming interested in what happens to the various NASA programs. This is a kind of maturing that does not always occur. Since there is now greater participation, primarily through the new planning system, and greater involvement of the peer group through the Management Council, there is a growing awareness in each Headquarters office and in the field centers of the problems of the other NASA components.

Reaction to the Planning System however, was mixed. Some participants believed it represented a major improvement in the formal planning process in NASA. Others felt that the System was overly elaborate with too many levels and groups; the field center directors were not adequately involved; the synthesis stage of the planning process was to be conducted by Headquarters rather than operating personnel; and the essential staff support for planning was lacking.

Chapter 3

Factors Contributing to Effective Management

In addition to the considerations cited above in connection with the several reorganizations, additional diverse factors contributed to the effective management of NASA during the decade of the sixties. They included a number of apparently opposite or contradictory concepts -- centralization and decentralization; internally generated forces and the influence of the external environment; administrative policies based on the conscious decision-making of senior management and a certain amount of fortuitous convergence of the right person with the right ideas at the right time; systems of management applied across the board and individuals with highly individual styles of management; an "in-house" competence within NASA Headquarters and field centers as well as a widespread competence fostered by NASA through contracting with the industrial sector; a certain pragmatism and a willingness to adapt proved techniques from any quarter as well as an adherence to some guiding concepts of management; and the challenge of a wide diversity of complex and difficult technical undertakings and the driving force provided by the stimulating challenge of landing men on the moon.

Discussion throughout the seminar series underscored the hypothesis that the high record of achievement scored by NASA in fulfilling its various missions could not be ascribed to any single factor. The participants differed as to their perceptions of the major features of NASA management. In fact, there was some agreement on the proposition advanced by one participant that "you cannot talk about the NASA system of management." The seminar illuminated significant distinguishing characteristics in NASA methods of management. But monolithic concepts of management were not considered the key to success. It was viewed, rather, as the result of an interaction of many factors and forces, often exerting countervailing pressures.

Leadership and the Troika. One of the major features of NASA senior management was the existence of a three man collegial executive. For most of the first five critical years of his administration of NASA, Webb was able to rely on his two principal associates who, with him, formed what came to be called the troika. This three-man directorship rested upon a mutual agreement on division of responsibilities according to areas of competence and a decision-making and administrative process operating through consensus. Dryden's scientific and technical background equipped him to provide the technician's expertise. He had joined NASA's predecessor organization, the National Advisory Committee for Aeronautics (NACA) in 1947, and became the head of that agency. Dryden served as Acting Administrator of NASA during the interval between Glennan's departure and Webb's assumption of duties in January 1961. Webb had known Dryden and had developed a high regard for his capabilities and judgment through earlier NACA associations. He therefore welcomed Dryden's designation by President Kennedy as Deputy Administrator.

The third member of the team, Robert C. Seamans, Jr., had also been a senior official of NASA before Webb's appointment, and the two had known each other when they had served together as executives of the Sperry Company. Seamans had acquired extensive engineering and R & D management experience through a career which included teaching at MIT, management of an industrial research laboratory and, finally, experience in NASA as Associate Administrator with jurisdiction over all of NASA's internal operations. Seamans, in effect, filled the role of General Manager of NASA during the Webb administration.

Recognizing the areas of special competence of his two principal associates, Webb focused his efforts particularly upon his own area of strength -- NASA's external relations and the cultivation of political

support. He served as the principal external link with the executive and legislative branches. Internally, he focused on the development of sound administrative and management practices. As the Administrator, he was the final authority, and the responsibility of his position could not ultimately be delegated. But he made it a point in practice to operate jointly with his two associates in what turned out to be a unique pattern of management of large-scale enterprise.

Webb's background and political contacts served NASA well. Webb and his colleagues made no effort to disguise the fact that support for the space program was closely linked to public support of it. By law, NASA was required to operate an "open" program. It enjoyed none of the opportunities of the Soviet space program to keep failures secret.

The caliber of leadership provided by the three senior administrators of NASA and the other top echelons of management, both at Headquarters and in the field, contributed to development of a climate of confidence both within the agency and in its external relationships with the public and with other parts of the federal government, notably the Congress. Under this leadership, the space program came to symbolize the effort to reinvigorate national life through science and technology. Top leadership of the agency saw NASA's mission as one which was closely linked to domestic goals, and this view was widely accepted at the time. This general acceptance of the importance of its mission and the high degree of confidence in the quality of its leadership helped to form a favorable environment for the space program.

At the outset of Webb's administration he and his two senior associates agreed upon a decision-making procedure to which they would adhere. The main elements of this system included the following: careful advance consideration

of the theoretical and doctrinal concepts upon which agency action would be based, mutual three-way agreement upon all important action programs and policy decisions, and, in the implementation and coordination stage, an understanding that each of the three could act more or less independently and, where necessary, in substitution for each other.

The system was exceptional in several respects. It juxtaposed three individuals of exceptional abilities whose strengths complemented one another. They shared together a large body of common or overlapping experience which fostered good communication, mutual understanding, and respect. The possibilities of duplicating such a combination of individuals in another time and place are remote. The system operated on the basis of consensus. In all their major decisions, the three men never failed to achieve unanimity.

The system worked efficiently in many different types of decision-making. It operated well in deliberations on the overall organization and management of the agency and on such specific and discrete issues as selection of major contractors for NASA programs.

The three men believed that one of their principal responsibilities was to oversee the source selection process. They formed themselves into a three-man committee which made the final determination of source selection for every contract over \$5 million.

Webb described the source evaluation process as follows:

...Dr. Dryden, Dr. Seamans, and I determined that we would personally examine, in detail, the results of the work of all source evaluation boards on competitively negotiated contracts that amounted to 5 million dollars or more. We expected these boards to appear before us personally in a formal setting and make a full and complete presentation of (1) the method chosen to break down for evaluation the contractor proposals, (2) the results achieved in the application of this method, and (3) the judgment of the board on each of the categories of the breakdown. The effect of this systematic approach to a continuous emphasis on the judgment factor has been that for

five years, on innumerable occasions and for extended periods, the three senior officials of NASA have sat side by side and personally examined in detail, and tested by question and answer, the quality of the individual and collective contributions of these boards to major decisions affecting the area where ninety percent of our resources are expended. We thus formed our own personal judgments, based on a great deal of personal involvement, as to the validity of board findings. We deeply immersed ourselves on a daily basis in very complete analyses of the main factors, within NASA and at the plants of our contractors, on which our projects depend for success, and the views, approaches, and analytical judgment of our senior personnel. In this process we were able to observe and evaluate how rapidly the organization and its contractors were developing their capabilities, and how effective our effort to get nine-tenths of NASA's work done by contractors was proving. We believe this constant and visible personal contact among NASA's three senior officials and the other responsible personnel involved in the hard problems and decisions in procurement provided a great deal of stimulation, motivation, and innovation throughout the organization.

The fact that the three senior officers of the agency would take the time to conduct what amounted to a thorough hearing and question-and-answer period on each contractor selection action enabled all levels of management, in Headquarters and in our Centers, to get their questions out on the table before all three of us for debate and clarification. Another important result was that, when the presentation to the three of us was over, everyone involved had a clear understanding of the elements basic to a proper decision and everyone in NASA concerned with the matter was aware of this. The burden then passed to Dryden, Seamans, and me to make the final decision, and the personnel of the boards were in position to form their own judgments as to whether the three of us did in fact arrive at the best decision as indicated by the facts and analysis. Further an important element of a NASA-wide and pervasive self-policing system was thereby established. This has had an important effect on maintaining high standards throughout the agency.⁹

Clarity of Goals. NASA is committed to achieving goals more readily definable in the discrete terms of the physical sciences than the goals of more social oriented agencies. Admittedly, the long-range goals of NASA are constantly evolving and there is a continuing process of review and refinement of the objectives of individual NASA programs and projects. But there is less room for ambiguity in the goals of space and aeronautics endeavors

9. NASA, Preliminary History of the National Aeronautics and Space Administration, Chapter VI, pp. 27, January 15, 1969.

than in most of the broad social and economic programs of other federal agencies and departments. Certainly, the basic objective of landing men on the moon provided a clear and tangible goal which inspired even those who were not directly involved in Apollo.

During his third year in office, in 1963, Webb began to develop the position that the space program, in a broad sense, encompassed goals beyond the development of a national space capability as specified in the space act. These goals included the provision of support to broad national objectives in the realms of both national security and domestic affairs. The space program was a means of providing thrust in critical areas of domestic, social, and economic affairs. Webb's deep personal interest in the university affairs program was an extension of this philosophy. Likewise, Webb was committed to the idea that NASA's goals included assistance to other government agencies in meeting their objectives and transferring to them some of the techniques and learning experiences developed in NASA. The emphasis on industry contracting was a means of channeling the stimulus from the space program into an important new sector of American industry.

This was the concept of NASA which generated broad public support and, in the Congress, support from both sides of the aisle. But, between the time when this concept prevailed and the time of Webb's departure from the agency, there was a falling off of such support. The spin-off from the space program which had been anticipated did not live up to the initial optimistic expectations. Despite the significant impact of space technology development in non-space fields, the perception of that impact in the eyes of the public and the Congress was less than had been anticipated. The internal NASA decision-making process was altered drastically by changes in the power structure in Congress. In the early and middle sixties, the Administrator was able to deal with three or four Congressmen and determine whether a program, or several programs, would be approved by Congress.

Later, it became extremely difficult to determine which Congressional offices could assess the mood of Congress on particular issues in the areas of NASA interest.

Other major issues on the troubled domestic scene in the latter half of the sixties began to compete with the space program. The anti-technology movement gathered new momentum. Webb was keenly sensitive to these changes and aware of the risk involved in trying to obtain commitment to a long-range plan for the agency. He felt obliged to maintain a range of options rather than closing off potential avenues of opportunity.

The emphasis in early seminar discussions on the importance of clarity of goals as a driving force for the overall agency effort was complemented in later discussions which dealt with the severe problems posed for an agency when its mission became less clear and when the sense of urgency or national commitment was reduced. If the early successes of NASA depended so heavily upon a drive to reach certain discrete and well defined goals, the failure later on to articulate comparable new goals might well be expected to weaken the driving force and the overall performance of the agency.

Mission Orientation. One of the recurring themes in the seminar series was the importance of mission orientation as a driving force. The second seminar, a discussion of the Office of Price Administration operations during World War II, pointed up a number of parallels and similarities in operation between that mission-oriented effort and the space program. In commenting on the OPA, on participant noted:

This, from the outset, was an extremely enthusiastic and dedicated, convinced group. They were convinced that, if they did not control and did not ration these goods, there would be economic disasters which would interfere with the war effort. They thought they were doing the most important thing they could do. For many of them, this was the most exciting thing they had ever done.

The parallel between the OPA and NASA which emerged clearly from this discussion was the importance of commitment to an overriding mission. Even though there were a number of apparent differences in the character of the two agencies, each was strongly mission oriented. The nature of the problems to be resolved in each case dictated the process for dealing with them and the process itself provided the major thrust for the program. The very mission of each agency inspired dedication among its personnel. One of the key differences noted by a NASA representative was the fact that OPA expertise was centered in Washington while NASA expertise was located, as noted above, primarily in the field. In each case, however, a central core of specialists, highly motivated by their personal sense of mission, kept the agency moving towards the fulfillment of its objectives.

A number of participants agreed in the final session that what drove the system more than any other factor was the engineering process or the basic technological nature of NASA's mission. That mission required bringing together in the proper interrelationship all the physical components necessary for the end product. The high technology nature of the NASA mission was the force which tied all the various elements of the total space program together in a working system.

One participant summarized this factor as follows:

This is the most cohesive organization because you have no other choice. The system requires it. Even people from very diverse backgrounds have been able to pull this off. This has been the tremendous strength of this organization. It has failed in some places. The (Apollo) disaster can be traced back to lack of cohesion, and other problems.

Centralized Management of a Decentralized Operation. One of the major sources of NASA management vitality and strength derives from the field centers. Some of these centers had been inherited from the National Advisory Committee on Aeronautics, some had been transferred from the military establishment, and the Jet Propulsion Laboratory of the California Institute of Technology had been attached to NASA by means of a unique contractual arrangement. Each of the ten

centers had its own very distinctive institutional personality and way of doing things. Each valued its professional autonomy. And each shared the traditional skepticism of the field towards Headquarters.

As NASA geared up for its mission, and particularly for meeting the tight deadlines of the manned lunar landing, the agency's options ranged between: (1) attempting to bring the field centers into a centralized and unified system of management; and (2) allowing the centers to continue in a decentralized relationship with a high order of independent managerial judgment to be exercised in the field. The course followed by NASA was roughly midway between -- centralized management of a decentralized field network. The centers were more or less their own masters in their special areas of competence, while Headquarters managed the total system and the overall interrelationships.

One of the seminar participants, who had played a role in the process of organizing the field center system, characterized the centers as follows:

These are strange beasts. They are multipurpose centers and are managed as what we now call 'mixed organizations.' They run all the way from a little bit of basic research to some rather large development projects. The fact that they are mixed organizations means that you have to handle the various groups doing various things in varying ways. Each of the pieces has to be managed differently. These are the types of organizations we are going to have lots of in the future. It takes a very clever guy to run one of these things. The important thing about NASA Headquarters is they never prescribe how to run a center. They aren't that naive.

Headquarters found that the centers had to be given wide latitude in determining how they operate. They required freedom to experiment. Center management was free to try out new ideas and approaches. If they worked, they received Headquarters support.

There are several lines of authority linking Headquarters and the field centers. Each field center director reports to a specified program Associate Administrator. For major programs or projects there are additional links. A

Headquarters Program Manager exercises a line responsibility with respect to a given undertaking. Another link between Headquarters and field centers consists of systems managers who have responsibility as a direct staff function, to assure that performance, cost, and schedule requirements for each mission are met. Finally, NASA augments its Headquarters/field "line" with the staff specialities in major functional areas of administrative management, legal counsel, safety, and public affairs. NASA's purpose has been to withhold from the line operator certain specified authorities to act until he has obtained clearance from the appropriate program or functional management element. Considerable care has been taken to determine the situations under which the line operator, the program manager, or the functional staff expert has responsibility to make decisions which are binding upon the others. Under such a three-way structure, managerial success depends upon extensive communication among people who share parts of the action rather than entrepreneurial defense of explicitly defined zones of delegated authority. This is not a place for the man who insists he can be responsive to only one boss.

The key to making the NASA structure work rests upon creating an effective network of formal and informal communications. Actual decisions are made by responsible officials in a fairly conventional way. To be on the safe side, NASA may err in over-communicating upward, laterally, and downward. The communications system engulfs anyone who can conceivably influence or implement the decision. In an unending effort to exchange information in real time, it uses telephone hot lines, executive aircraft, datafax, long distance conference hookups by voice and data display, and computer data transmissions.¹⁰

10. For a discussion of NASA internal communications see Albert F. Siepert, "NASA'S Management of the Civilian Space Program," a speech prepared for TIMS (The Institute for Management Science) in New York City, March 28, 1969.

An important aspect of Webb's management philosophy, which shaped the framework for decision-making throughout his administration of the space agency, was his strong preference for a system that would permit many alternatives to be considered all the way up to the top levels of the agency. He sought to avoid becoming "the prisoner of preferred solutions." He recognized a serious danger in decision-making machinery involving so many people at the higher levels that decisions are delayed or watered down. At the same time, Webb sought to avoid a process at the working levels in which too few viewpoints were represented and the range of alternatives was narrowed down prematurely.

Despite all the communications linkages and multiple Headquarters/field center interfaces, there was some feeling, as voiced by Webb in the first seminar, that the total system had not been very successful in bringing the practical judgments of field center directors to the attention of the senior administrators. The upward flow of field center inputs to top Headquarters levels was sometimes impeded. The General Manager system, which funneled administrative matters into the Associate Administrator's Office, sometimes proved an obstruction. But the nature of NASA's task in the pre-Apollo period may not have required as much interchange as was needed when the post-Apollo transition began. Then the building of good communications between Headquarters and field centers became one of the major problems of agency administration.

During the mid and late sixties, the concept of centralized management of the decentralized operation of the field centers worked quite effectively towards achieving the technical goals of the space program. For the most part, the individual field centers tended to pursue their own interests in a somewhat parochial manner, collaborating with other centers as necessary towards fulfillment of specific program goals and objectives.

Adaptability and Experimentation. A principal hallmark of NASA management was the premium placed on adaptability, flexibility, and experimentation.

It provided for dynamic interaction between the NASA structure and the environment within which it operated. It provided for rapid feedback of information and decision-making to take account of changing circumstances.

The leadership of NASA was not interested in stability or equilibrium for their own sake. It recognized the positive value of conflict and imbalance, provided they contributed to getting the job accomplished. It was apparent from the beginning of the Apollo program, for example, that it would become by far the dominant program in NASA and that the success of the entire agency would be judged in terms of its performance. The Office of Manned Space Flight obviously would become the largest and most powerful of the four program offices in NASA.

The following table shows the relationship between allocations for manned space and the total NASA budget for the decade 1961-1970. During that period, the ratio rose from 43 percent in fiscal 1961 to a peak of 69 percent in fiscal 1968.

Relation of Total NASA Budget
to the Manned Space Program
(in millions)

<u>Year</u>	<u>Total NASA</u>	<u>Manned Space</u>	<u>Percentage of Manned Space to Total NASA</u>
1961	\$ 964,000	\$ 416,000	43
1962	1,825,300	914,000	50
1963	3,674,000	2,253,000	61
1964	5,100,000	3,421,000	67
1965	5,250,000	3,425,000	65
1966	5,175,000	3,509,000	68
1967	4,968,000	3,385,000	68
1968	4,589,000	3,146,000	69
1969	3,995,000	2,499,000	63
1970	3,696,000	2,374,000	64

Although a great deal of NASA unmanned space and aeronautics activity had little or no connection with the manned space program, the latter provided a stimulus and a driving force felt throughout the Headquarters and the field centers. NASA administrators came to perceive certain positive benefits deriving from the imbalance between the manned space and other NASA endeavors.

Built into NASA management in the 1960's was a full recognition that the primacy of the Apollo program was a fact of life with many implications for the overall space program. The Office of Manned Space Flight (OMSF), which controlled such a sizable share of the total NASA financial and personnel resources, quite naturally came to see its role as being more than that of an equal among all NASA programs. In fact, the very question of the imbalance between OMSF and the other program offices was a subject of deliberation in some of the early meetings of the NASA Management Council. These discussions brought out a recognition on the part of the Associate Administrators of the other program offices that the manned space flight mission represented an extremely valuable thrust for the total space program, and that the overall program would suffer from the absence of a program offering a comparable forward thrust for the agency.

The discussion of imbalance and the competition for resources within NASA led into the corollary discussion of how, given these somewhat divisive forces, NASA managed to operate as a cohesive unit in the execution of programs. If there was imbalance between OMSF and the other program offices, if there was institutional friction between Headquarters and the field centers, and among the various field centers, how was it possible that NASA programs achieved their objectives successfully? How had the Apollo program maintained its timetable?

Discussions in the seminar frequently returned to the concepts of

adaptability and experimentation. Senior administrators, it was noted, were open to suggestions for change and willing to adopt the best management techniques from whatever source, even at the cost of disturbing and unsettling existing organizational patterns and relationships between individuals. Whatever management innovation was achieved came on the basis of an eclectic and pragmatic approach. The senior administrators saw their task as one of effectively organizing the use of what was at hand in the total inventory of national resources and capabilities. They recognized that, for the NASA mission, as for most large scale enterprises, the basic knowledge and technology and the human and material resources were available. To achieve an effective large scale management systems, senior administrators concentrated continuing attention on the restructuring and organizing of existing resources and technological competence.

In-House Competence. Under statutory requirement, NASA activities are to be so conducted as to make "the most effective utilization of the scientific and engineering resources of the United States" with participation by the scientific community in planning scientific measurements and observations and with "the widest practicable and appropriate dissemination of information concerning its activities and the results thereof." From the start, NASA has developed and used a combined government-industry-university basis upon which to build its aeronautics and space programs. The concept was established during the first five years of NASA's existence and it is fundamental to NASA's operations. The integration of all these resources in a single system has been described as "participative responsibility."

As NASA began to move forward into the implementation of the new programs that had been proposed by President Kennedy in 1961, the magnitude

and complexity of the civilian space program became apparent. The collaborative team of government, industry, and universities which NASA had set out to assemble was seen as a necessary way to carry out the space program. The agency's program, therefore, was to be conducted not by NASA alone. Its accomplishment was to depend on a complex of resources, successfully drawing together organizations and capabilities of all segments of the national economy, and integrating them into an effective operational system.

In Webb's words,

We have sought on the one hand, to minimize the disruptive effects of what has necessarily been a vast undertaking, and, on the other hand, to so conduct our operations as to strengthen in every way feasible the positive values of our society and its institutions. We rejected a proposal by one large industrial firm to do the entire lunar landing job single handed, as well as a similar proposal by a leading university to operate a laboratory that could do all the scientific research.

We decided as a matter of deliberate policy to place principal reliance on the American industrial establishment and the American university system as a whole. We decided to focus our governmental efforts principally on developing the needed in-house competence to make responsible decisions, and on organizing and managing.¹¹

For example, NASA could bring in experts from its field centers, from universities, or from other government laboratories easily and without the contractor having to "lose face" institutionally in tackling an intractable problem. The concept was to manage the project on a teamwork basis in order to avoid unnecessary delays that otherwise might be occasioned by working

11. James E. Webb, Space Age Management: The Large-Scale Approach, McGraw-Hill, pp. 113, 1969.

across organizational boundaries separating public, private, and semi-private organizations. The same practice applied to NASA's field centers and project groups -- organizational boundaries were not to interfere with the application of needed talent. Respect was to be maintained for the semiautonomous status of the NASA field centers which were the locus of most of NASA's technical talent in depth. This required a different organizational construct from that of previous project management. NASA leaders were unwilling to accept the prevailing style of project management most typically found in the Department of Defense (DOD) throughout the 1950s and early 1960s. The DOD approach was characterized as writing tight specifications for the development program, letting the contract, and going away until the project emerged. The weakness in this system was that it did not provide for satisfactory, positive intervention by the customer (the government agency) in the solution of, and decision on, the technical problems which inevitably arise in a development program.

In contrast, the NASA concept is that no single company, regardless of its excellence, has all of the skills and experience required for the execution of a large space flight project. Therefore, although relying predominantly upon the aerospace industry to build, integrate, and test flight hardware, NASA used its in-house management and technical competence, which it had in considerable breadth and depth, to monitor and work with the contractor. NASA retained the authority and the means for tapping a much wider variety of technical competence to overcome problems confronting a contractor on a project.

Program and Project Management. In NASA terminology, a "program" means a related series of undertakings which continue over a period of time

(normally years), and which are designed to accomplish a broad scientific or technical goal in NASA's long-range plan, such as Lunar Planetary Exploration. Program responsibility is assigned to the appropriate program office within NASA Headquarters. A "project" is an undertaking with a scheduled beginning and ending, within a program, normally involving the construction and operation of one or more aeronautical or space vehicles and necessary ground support in order to accomplish a scientific or technical objective; or the design, development and demonstration of major advanced hardware items; or the design, construction and operation of a new launch vehicle.

NASA has identified the program manager's vis-a-vis the project manager's role as follows. A program manager is the senior NASA staff official exclusively responsible for developing and administering the Headquarters guidelines and controls. He is the focal point of all NASA Headquarters activity bearing directly upon those projects which comprise his program. He is responsible for developing and administering the Headquarters guidelines and controls under which those projects are conducted. On large space flight projects, the program manager frequently has cognizance over only one project.

A project manager is the senior NASA official at the field center exclusively responsible for the execution of a project within guidelines and controls prescribed by NASA Headquarters and his field center management. The project manager is the focal point of all field center activity bearing directly on his project. He carries out these responsibilities within his delegated authority in the name of the field center director. Much of the actual work may be performed outside the project organization in divisional offices, in other parts of the agency, or in the contractor firms by people outside the

project manager's direct administrative authority. On project matters, however, these individuals take direction from the project manager.

NASA's organizational structure is designed to provide the essential support to the project manager while balancing support against the broader program goals of NASA. In effect, there is a dual system of project control. The role of the project manager can be characterized as "Mr. Inside," responsible for the day-to-day supervision and the execution of the project as carried out by industrial contractors, NASA and other government laboratories, and university experimenters. The program manager fulfills the role of "Mr. Outside," fighting the battles of resource allocation within NASA Headquarters, preparing testimony and justification for Presidential and congressional authorization, working with other government and nongovernment organizations interested in or participating in the project, and monitoring the project execution to control significant variations from the Headquarters approved Project Plan. Each has a critical and specific (sometimes conflicting) role to perform; but, in the positive sense, they are seen as mutually supporting (when performed correctly), constituting a critical axis of relationships.

Executive Personnel Management. In comparison with most other federal agencies, NASA enjoys unusual discretionary authority with regard to its executive personnel. The Space Act of 1958, as amended, gave the NASA Administrator the authority, within limits, to appoint and fix the compensation of scientific, engineering, and administrative personnel, now numbering about 500, without regard to Civil Service appointment and compensation laws. Initially a \$19,000 per year ceiling was placed on the bulk of the positions and a \$21,000 ceiling on the balance. At that time, the highest grade -- GS-18 --

under the Classification Act had a single rate of \$17,500 and the \$21,000 level was the same as that for heads of major independent agencies and most departmental Under Secretaries.

From the early days of NASA, especial attention was given to the use of this authority. Administrator Glennan, on October 28, 1958, issued a policy statement providing that: (1) authority to make excepted appointments would be used to attract and retain personnel vital to the agency; (2) salaries would be made as competitive as possible with industry; and (3) identical eligibility criteria would be used for current and for new executive personnel. In addition, the Deputy Administrator and the operating office directors were to make recommendations to the Administrator on the establishment of excepted positions and appointments to fill them, recommendations on appointments were to be based upon thorough appraisal of the individual, and all positions were to be reviewed annually.

This special authority enabled the NASA Administrator not only to recruit, appoint, and fix the compensation of a relatively large number of key executives but also to dismiss, demote, or transfer such persons. The importance of this latter flexibility to the success of NASA is underlined by the following statement by Administrator Webb:

One of the most important things we have done in NASA has been to encourage good executive performance and executive development through constant "upward pressure." We have followed, wherever possible, the practice of deliberately assigning to our executives jobs outside of their normal range of experience and beyond their demonstrated competence. I am not talking about a "job-rotation" training system. Our object is to challenge, under firing-line conditions, the ability of the executive to perform at a higher level. Such purposeful shifting of personnel to new and more difficult jobs--and an often-accompanying process of trying out a new organizational concept--might be characterized as a form of "designed disequilibrium." Through it, both weaknesses and strengths in the executive group are surfaced, as are also many organizational deficiencies and needs.

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The practice is a tough one. It can be hard on the individual who finds himself out of a familiar groove in which he has been doing quite well and in a new and trying situation where he has to struggle to keep his head above water. It can also be costly to the agency when executives who have been adequate at a lower level are found to be inadequate in the higher job. However, these are not too-high prices to pay for continued development of strengths, for removal of weaknesses, and for identifying executives of the highest quality.

The value of such an approach is sufficient, in my mind, to justify consideration of a system of periodic "selection-out" actions in the lowest 10 percent of our approximately two hundred project managers. Such a selection-out decision could well be made even if a manager were judged adequate on his present job. The aim would be to keep a systematic pressure on the entire system, forcing identification of managers capable of handling complex programs such as the Apollo project, the Manned Space Flight program, or the job of the Administrator.

Another aspect of the matter is that in a large complex endeavor the situation is too fluid to permit the fixation of either jobs or people in jobs. The nature of tasks and demands changes too rapidly for a static setup to be effective.¹²

In reflecting upon the manner in which this special authority had been used and the results upon NASA, one participant commented:

People have been tested. Some have been stressed near their yield points. Personally, I believe this has been to the great benefit of nearly all the individuals concerned as well as to the betterment of the organization. The disasters have been very few. In general, people have been stimulated and have grown. Qualities have been discovered in executives that otherwise likely would not have been. It has been an experiment, not without some costs but, on the whole, very beneficial.

There is little doubt that the flexibility given NASA by this special authority has been a major factor in attracting and utilizing high caliber executive personnel and has contributed significantly to the success of the NASA program.

12. James E. Webb, Space Age Management: The Large-Scale Approach, McGraw-Hill, pp. 159-160, 1969.

Chapter 4

Central Problems

A survey of the factors contributing to NASA's success reveals how many were peculiar to the time and circumstances. Strong external political and public support, an exceptional three-man leadership team in the Webb, Dryden, Seamans combination, and the central thrust provided by the Apollo mission were all unique attributes of the time. As these conditions and circumstances changed in the late sixties, new kinds of problems began to require the attention of NASA senior administrators. Discussion in the latter phase of the seminar series focused increasingly on the problems of transition and particularly such issues as the planning process, matching capability with workload, maintaining organizational vitality, and the system of checks and balances.

Planning. Planning the long term future of the space program in terms of specific goals and objectives and the correlated task of determining which programs would be marketable have proved to be among the most difficult tasks of NASA leadership. Despite the continued existence of a planning office reporting to the Associate Administrator and despite task forces and committees formed expressly for the purpose of comprehensive planning, the agency encountered great difficulty in setting future objectives which could gain adequate levels of support from Congress and the public. The problems encountered by NASA in defining its future goals were discussed at length in the seminar. These discussions revealed that external or political factors played a determining role in shaping the planning function of the agency. Administrative considerations, such as where the planning office was

located and how it was structured and staffed, tended to be of secondary importance in comparison with external factors such as changing Congressional attitudes and diminishing public concern about Soviet competition in space.

The NASA Preliminary History cites three major periods of decision on U.S. space policy and NASA funding under Johnson's five year Presidency.¹¹ Early in 1964 Johnson asked Congress for strong backing for a program designed to give the United States pre-eminence in space. Congress responded positively and, during 1964, 1965, and 1966, the NASA budget was at its maximum level, ranging from \$5.1 to \$5.25 billion a year.

In 1967 President Johnson sought Congressional approval for continuing the production and use of the Saturn-Apollo space system and for several new programs for the next decade. On this occasion, for the first time, he received a limited and uncertain response.

In 1968, as the Preliminary History notes, "the failure to start new long lead-time projects and limitations on NASA funding placed NASA in the position of emphasizing the completion of current programs for the Sixties and striving to find some way not to face an almost complete cessation of flight missions in the Seventies." As of that time, all on-going NASA projects were based on plans adopted in 1961-62. In effect, the overall program of NASA, under way in 1969, had not been supplemented or altered in any substantial way from the concepts developed almost a decade previously. This caused considerable concern among working levels of NASA personnel who felt a need for a plan extending beyond a lunar landing.

One of the seminar participants pointed out that there had been a vacuum in long-range planning in the first half of the sixties because NASA leadership did not want a long-range plan developed. Although it was not

the official external position of the agency, NASA leadership gave explicit instructions within the agency not to develop a single long-range plan. This instruction, however, did not preclude development of plans and long-range cost projections for specific programs requiring a long lead-time for development. In this period, Apollo and Apollo extension programs provided the main thrust for NASA, and it seemed to NASA senior administrators that the most valuable contribution to be made in the planning area was to focus on the short and medium-term. But, by early 1965, the need for long-range agency-wide planning had been generally recognized. A considerable amount of effort was then devoted to what was called the Future Programs Task Group, whose report was submitted to President Johnson in February 1965.

The atmosphere in which the Future Programs Task Group operated was characterized by a lively new interest in post-Apollo planning. Both within NASA and in other agencies with related interests and especially in industry groups involved in the space program, attention focused on the need for planning the follow-on to Apollo. At this point in time there remained a good deal of uncertainty concerning Apollo itself, how it would progress in the years ahead, and whether it would meet projected schedules. For the most part, however, attitudes were marked by a high level of confidence. But a considerable degree of uncertainty about the future of the Apollo program complicated the task of post-Apollo planning.

The series of successes scored by the Gemini program reinforced the sense of confidence in the United States space program. Ten launches, each involving two astronauts, contributed to this confidence. The Russian manned space program, on the other hand, while it continued to be active, featured fewer manned flights with relatively longer gaps between launches. The official

position of NASA, reflected in attitudes permeating the agency, was that the mission of a manned lunar landing was merely the beginning of a national space program whose long-term objectives encompassed broader and more ambitious goals. It was assumed that achievement of these goals would require further expansion of the space program as a whole.

As increased attention was focused on looking ahead, however, it became clear that formulating and obtaining agreement upon future plans would present some very difficult problems. It was evident that approved programs were running out. Initiating new program starts was not going to be as easy as had been generally assumed earlier.

The accumulated experience of NASA up to the mid-sixties indicated that there was a considerable range of new space activity opening up for potential development, including the orbiting space station, the space shuttle, manned exploration of deep space, extended lunar explorations, and orbiting astronomical observatories. Any one of these undertakings would require extended effort in planning, budgeting, and conducting the program. Any one would involve a large-scale expenditure over a period of years. Selling any one of these ideas was a far more difficult job than NASA had encountered in obtaining support for Apollo and other pre-Apollo programs.

Upon submission to the President of the Summary Report of the Future Programs Task Group early in 1965, Webb recommended that the document be made public in order to facilitate a national debate on what the United States should do in the post-Apollo era. When released, the report helped to meet the need for a standard agency posture on what future programs might be. The report defined the various kinds of activity that could be undertaken and the kind of technology needed in each case. However, it was subsequently

criticized for what was called a somewhat "bland" quality and for the lack of a range of program mixes into various alternative plans for adoption by the agency.

In President Johnson's 1965 budget message to Congress, only two new program starts were recommended. One was the Voyager, a new unmanned spacecraft designed to explore the planet Mars. The second was a request for funding of the Apollo extension system designed to study how NASA would use the capability developed through Saturn and Apollo. Although Congressional hearings on this budget request evoked some questions concerning what NASA had developed in the way of hard plans for future programs, the NASA authorization and appropriation bills came close to the President's request.

The nature of NASA's future planning at this time was dictated by the strategy adopted by Webb. Within NASA a great deal of the planning effort had centered on new programs which were completely unrelated to Apollo. Webb and his principal associates were concerned about the possible unfavorable impression that would be created in Congress and the public if NASA were to submit a long-range plan concentrating on new programs without fully exploiting the range of capabilities developed at great cost in Apollo. Although there was widespread belief within the agency that NASA was in a good position to advance a single long-range plan for the future, the three senior administrators were reluctant to present to Congress a monolithic plan which could become a target for those wishing to cut back the space program. In all likelihood, the Senate and House space committees would both have endorsed such a plan, but it was questionable whether either of the two houses would have passed legislation based on a more specific plan than that offered by the Future Programs Task Group. In any event, the decision at the time was not to advance a single long-range plan.

By early 1965, NASA planners had become increasingly aware of the long lead-time required to move from the planning stage into the actual start of a program. Concurrently, there was an increasing recognition of the importance of working out a system within the agency for holding the planning of the several programs together. The Planning Coordination Steering Group was established with the full endorsement of NASA senior management to help meet this need. It consisted of the top management of each of the Headquarters program offices. It was supported by a series of working groups, operating on a more or less continuous basis, which examined the progress of on-going programs and the planning of new programs. Although it operated somewhat informally at the outset, it served as a useful stepping stone to the kinds of planning machinery which were adopted in the sixties.

In the 1965-66 time frame, NASA undertook several efforts to create a greater cohesiveness throughout the agency by relating current and immediate-term future plans to long-range planning and by drawing the Headquarters program offices and their associated field centers closer together with the above mentioned planning coordination machinery. In the Office of Advanced Research and Technology (OART), for example, an advanced research and technology board was set up consisting of all the center directors plus the Associate and Deputy Associate Administrators of OART. The board's function was to review the progress of current programs while also overseeing near-term and long-term planning. Similar functions were performed by a senior council in the Office of Space Science and Applications and by a planning council in the Office of Manned Space Flight. These groups were very active during 1965 and 1966 and contributed towards a more effective meshing of the on-going NASA program activities and the several planning efforts.

During 1967, the planning machinery was further developed into a more formal and elaborate system which, by 1968, was officially designated "The NASA Planning System."¹³ It provided a procedure for "(a) developing plans, programs and budgets for consideration by NASA Management for internal planning purposes and (b) developing data and information required for NASA's annual submissions to the Bureau of the Budget..."

As one seminar participant pointed out,

The Planning Steering Group is organically fitted to the line organization so as to draw line and staff together in the accomplishment of their jobs. It is managed so as to preserve the important differences of the line and staff, however. This is not just a homogenization of the two, but rather again a recognition that line and staff have to work together. Staff has a critiquing function and the line has an operating function, and these must not be compromised. Critiquing does not mean finger-pointing but rather offering assistance, providing another point of view, and assuring that things don't fall between cracks.

The goal of the NASA Planning System was to expose a range of alternative possibilities and to develop a total perspective for top management -- not to set a course which would have to be followed without deviation. The process was intended as a means of facilitating top management's forward planning and allocation of resources. Discussion in the seminar raised a number of serious questions about the utility of the system.

Perhaps the most serious reservations expressed about the System concerned the issue of how much of a real impact the planning process actually had on decision-making by top management. Some participants expressed the view that planning had become a somewhat isolated function and that the top levels of management in Headquarters and in the field centers based decisions affecting the long-range future on other considerations than the plans emerging from the planning process.

13. Memorandum, NASA Planning System, September 11, 1968.

One of the constraints upon the System stemmed from the fact that each Working Group was required to operate within the limits of proposed budget ceilings for the coming year. The possibility of significant new departures in future plans was limited by the need to accommodate on-going programs and the availability of only small incremental funds for major new starts. More often than not the process culminated in proposals for increases or decreases of no more than five percent in existing programs. It was pointed out, however, that this is a common problem in all planning activity.

Another problem within NASA, affecting the planning process is the highly independent role of the field centers. It was pointed out that the extent of decentralization of the NASA centers is greater than found in any other government agency, with the possible exception of the Atomic Energy Commission. The centers' inputs into the planning process must be closely in line with the thinking of top center management. This places a premium on the active participation of center directors in the planning system.

A very different kind of administrative environment began to prevail in the late sixties. It had been a fairly straightforward matter to relate the Headquarters and field centers when they were all working towards fulfillment of clearly defined and well accepted objectives. But it became more difficult to maintain effective relationships when future goals of the space program were being deliberated and a good deal of uncertainty replaced the earlier clarity of mission. Furthermore, in the first half of the sixties, NASA was a rapidly expanding organization whose future seemed to promise even more growth potential. It was one thing to manage such an organization, whether at Headquarters or in the field, and quite another to manage an organization facing declining levels of support.

In effect, this is what NASA and its field centers have been facing in the years since fiscal 1966. From fy 1966 to fy 1970, NASA's annual budget dropped from \$5.175 to \$3.7 billion and its manpower fell from nearly 34,000 to around 30,000. During these years, it became increasingly critical for most of the field centers to develop new alternative uses to absorb excess capacity.

NASA increasingly confronted the difficult task of matching workload with capability in the field centers. Centers tended to bid for more work outside of their historical area of expertise than in the past. This, in turn, blurred the distinctions between the centers. As a result of centers bidding for new work, decisions were forced about shifting workload to keep the centers in balance. One seminar participant noted that, "There are serious dangers in a situation in which the centers have more capability than work to go around and are bidding against one another. There is a risk that the centers will appear to be competing without reference to agency goals or national objectives." The critical question posed at that point in time was whether the space agency could survive in the changing market situation after the men returned from the moon. One key to survival was seen to lie in pulling work back from industrial contractors and placing it in the centers.

A seminar participant commented that, while the idea of bringing work back from the contractors to the centers deserved thorough consideration, the situation of the centers was complex and difficult to resolve. The centers which faced problems in retaining capability and adequate workload were, to a large extent, those concerned with manufacturing large missiles. With the Apollo program well developed and with no big missiles to design, build, test, and launch, these centers faced serious difficulties. They were limited

in the extent to which they could divert personnel from the Apollo program. Nor was there work that could be brought in from the contractors. They were not able to undertake new work. But, when Apollo ends, their staff would be surplus and there would be no work for those centers to perform. The remainder of the centers -- those concerned with non-manned and aeronautics projects -- were not in such severe difficulty.

Maintaining Organizational Vitality. One of the principal recurring themes of the last four seminar discussions was the question of organizational vitality and the effect upon NASA of the aging process. The discussion did not lead to any clear conclusions and there was no consensus on such issues as whether such loss of dynamism as had occurred was the inevitable consequence of the passage of time. No one questioned that there was, in the post-Apollo era, a great deal less dynamism than in the previous period. Nor was there much doubt expressed that NASA had lost something of value in the diminution of the kind of adventuresome spirit which had characterized the agency in the early Sixties. Among the most serious effects, it was suggested, was a tendency on the part of operational elements within the agency to limit the scope of future undertakings to activities which were not too difficult of accomplishment. Rather than accepting the kind of challenge represented by Apollo, the temptation was to trim down to less ambitious objectives with smaller resource requirements.

A number of explanations were advanced for the change in character of the agency. Some pointed out that this kind of change takes place in all government organizations after a certain period of years, usually somewhere between the fifth and tenth year. In the early years of an organization, administration and operation have not come under the control of bureaucracy.

Individuals operate relatively freely and without the constraints of multiple reporting systems and clearance procedures. Business is accomplished quickly and informally through person to person interchange. There are fewer clearance points and committees to be consulted in the decision-making process. Decisions are not submitted to as many reviews by higher levels. The aging process, however, usually entails an overlaying of management, the building of a hierarchical structure of decision-making, and an institutional inertia which reduces the vitality of any public agency.

Another hypothesis advanced in the discussions was that, after its first five to six years, NASA experienced the effects of elimination of ultimate unknowns. In any new scientific enterprise, the first years are a period in which bold imagination can lead to high expectation. With time, the limits of near and medium-term scientific exploration begin to be defined. So, in the case of NASA, time produced a clearer picture of what could and could not be accomplished in space exploration given the limits of manpower and budgetary resources. The willingness to accept the challenge of pushing out the frontiers of knowledge and seeking breakthroughs in man's understanding of his universe falls off as those engaged in an endeavor become attuned to what is feasible and practical.

Another way of looking at this same question is to consider the willingness of an agency to discontinue areas of endeavor with limited potential reward. It becomes difficult to obtain consensus on terminating an activity which has been initiated and involves an investment of time and money. Once a multi-million dollar program becomes institutionalized, even though all concerned recognize that it is approaching the point of diminishing returns, it becomes difficult to terminate the program. Such programs tend to gather

a certain amount of internal inertia which does not yield readily to outside forces. It was suggested that, to some extent, real organizational dynamism is the capability to single out the most rewarding avenues for future activity and to turn off unpromising undertakings without excessive deliberation.

Checks and Balances. In the period following the Apollo fire, Webb sought to improve the decision-making process through several means, including a system of checks and balances for monitoring major areas of agency activity and better self-policing of the implementation of decisions. The discussion of these various moves revolved around the issue of whether they tended to make for better decision-making or whether they reduced the effectiveness of the decision-making process by overloading it with controls.

It was noted, for example, that a good system of checks and balances can serve the interests of the agency and individual managers but that "there is a delicate line between constructive and destructive checks and balances." Useful "conflict," it was noted, can be achieved through structured discussion among peers. This process ideally results in a situation in which each higher level of responsibility or authority can rely on the work of those at the next rung down the ladder with confidence in the integrity of their decision-making. When this faith appears to be no longer justified, when the self-policing mechanism seems no longer to be working, there is the temptation to set up new and complementary systems of checks and balances. This duplicating or overlapping of action or line assignments can result in kinds of conflict which may be costly and counter productive. The effort to enforce effective self-policing in the 1967-68 period resulted in a somewhat hardened structure which over-checked and overbalanced. Thus, as one of the seminar participants noted:

I have been amazed at the relatively few things that can be done by a single individual as his sole responsibility. There are cross checks built into the organization in such a way that I get the feeling that it was hoped that if this guy didn't do it, that guy would, because it wasn't a divided responsibility. It was almost a dual responsibility.

One of the principal dilemmas of management is to find the right mix of delegation and internal checking. Too much delegation without adequate checks can lead to loss of control and potentially poor performance. Limited delegation and excessive checks make the machinery of administration move so cautiously and laboriously that it loses much of its potential.

A good example of how NASA has applied the checks and balance system for self-policing is in the monitoring of contractors. As one of the participants noted, NASA monitoring allows a contractor considerable freedom. For the most part, he can do just about whatever he wants to. Ordinarily, NASA does not require on-site location of its monitoring teams nor a one-to-one match of in-house to contractor managers. The contractor does not have the feeling that he is being watched every minute of every day, but he is aware that NASA representatives will not hesitate to challenge any decision or action of which they disapprove. A key point in effective monitoring is the requirement that the information system checking the line operation must be an open and structured arrangement rather than a covert or Gestapo-type mechanism. This concept was violated when the Executive Secretariat was given the mission of gathering data and feeding it into the top decision-making levels of NASA without keeping the line organization informed. Although the line offices had the expertise, knowledge and ability to assemble and disseminate data, they were by-passed by the Executive Secretariat whose assignment was to penetrate the line structure. One participant contended that this arrangement could have worked if it had been an open proposition with the Secretariat making its

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reports available for review by line officers before they were formally submitted to senior management. He expressed the view that both line and staff "have to have the opportunity to get to the heart of the matter" so that all data points are consulted and that total reliance is not placed on the line or on the staff.

The kind of line-staff problem which developed in NASA has appeared in many other federal agencies. In this situation, top management, in effect, becomes the prisoner of its staff organization. The latter not only develops its own network of information reporting but also takes on a decision-making role. On the side of the line organization, the withdrawal from full participation may result either from an insufficient delegation of responsibility or a virtual abdication of line authority. In either case, line managers no longer identify with the total agency mission. They lose the sense of commitment to higher level decisions in which they have not fully participated. In the words of the memorandum on management principles discussed earlier in Chapter 3, the adverse effect of duplicate assignments where operational responsibility is involved "can be devastating, tending to confuse responsibility, introduce divisiveness, attack morale, increase confusion inside and outside the agency, and increase the work on some items while dropping others between the cracks." One participant noted that, in the past, this lesson has not been sufficiently understood by various occupants of the White House and their staffs.

One of the major sources of trouble in line-staff relationships occurs when the staff group chooses to operate, or is forced to operate, off to one side. If staff groups try to make themselves look good simply by pointing out to top management the mistakes being made by line offices, they are not fulfilling their supporting role. Staff and line find themselves at loggerheads and the whole system breaks down. This does not mean that staff personnel must necessarily agree with line operators on every issue. There is obviously

room for legitimate differences of opinion. What matters is the degree of respect that the line develops for staff. This, in turn, depends on both the technical competence and the methods of operating of the staff personnel.

One participant expressed the view that, despite some legitimate differences arising between the line and staff, most of the traffic between the two should produce agreement. Difficulties are likely to trace back to incompetence on one side or the other, in which case the only resource is removal of the incompetent.

Related to the issue of the staff-line relationship was the seminar discussion of the principle of economy of effort. The discussion dealt with the question of how much duplication and overlap of assignments is desirable and productive in an organization. While there was some agreement that a manager needs to consult a variety of sources and to obtain different opinions before reaching technical decisions, it was also agreed that a conscious policy of multiple or overlapping assignments can be counter productive. A policy based on distrust or suspicion by making covert assignments to different people is likely to wind up with friction and low morale.

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These were the kinds of issues with which NASA administrators were wrestling as the Academy seminar series drew to a close in April 1969. Although events have overtaken some of the concerns of the seminar participants at that time, many of the problems remain, albeit in a modified form, today. Those who were laying plans for the future of the space program in the Spring of 1969 could not have perceived many of the significant changes in the external environment in which NASA was to operate.

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